An Algorithm for PDE Consistency under Constraints with an Application to Relativistic Cosmology

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Abstract

This paper presents a method to impose constraints on solutions to systems of partial differential equations. By systematically imposing integrability conditions on constraint equations, it is sometimes possible to simplify a system or to develop a contradiction. Factorization of derived constraints implies a natural disjunctive case structure on the space of solutions.

We demonstrate this method in an application to relativistic cosmology, where geometric constraints are applied to a class of locally rotationally symmetric space-times. We show how "intrinsic symmetries" may be imposed on families of geometrically well-defined surfaces, and the implications these have on the field equations.